Washington DC - Richmond Passenger Rail Study - Detailed Information

Table of Contents

The GENERAL ASSEMBLY'S REQUEST

THE DEPARTMENT OF RAIL AND PUBLIC TRANSPORTATION'S ASSIGNMENT

THE CORRIDOR STUDY'S FINDINGS

- **An Historic Precedent**
- **Future Demand**
- **Future Revenues**
- **Annual Operating and Maintenance Expenses**
- **Needed Improvements**
- **Cost Projections**

RELATED CORRIDOR ENHANCEMENT STUDIES

- **Preliminary Corridor Investigations (James R. Smith)**
- **Richmond-Hampton Roads Study (Donald W. Dodson)**
- **Third Track/High Speed Train Scenarios (Wilbur Smith Associates)**
- **Richmond Multimodal Transportation Center (Wilbur Smith Associates)**
- **Environmental Considerations**
- **Land Use Strategies**

CONCLUSIONS

THE GENERAL ASSEMBLY'S REQUEST
In the FY 1993 Budget Bill, the General Assembly of the Commonwealth of Virginia passed the following legislation:
The Secretary of Transportation in conjunction with the Department of Rail and Public Transportation and the Department of Transportation shall perform a study of the rail freight and passenger demands of the corridor between Washington, D.C. and the Richmond area. The study shall include an assessment of the existing conditions, capacities, and improvements needed. The study will also include a preliminary engineering feasibility analysis of the corridor between Richmond and the Tidewater area. The study shall be completed by January, 1995. (Item 556 D of Chapter 994, 1993 Virginia Acts of Assembly)

THE DEPARTMENT OF RAIL AND PUBLIC TRANSPORTATION'S ASSIGNMENT
To accomplish the study, four tasks were conducted:

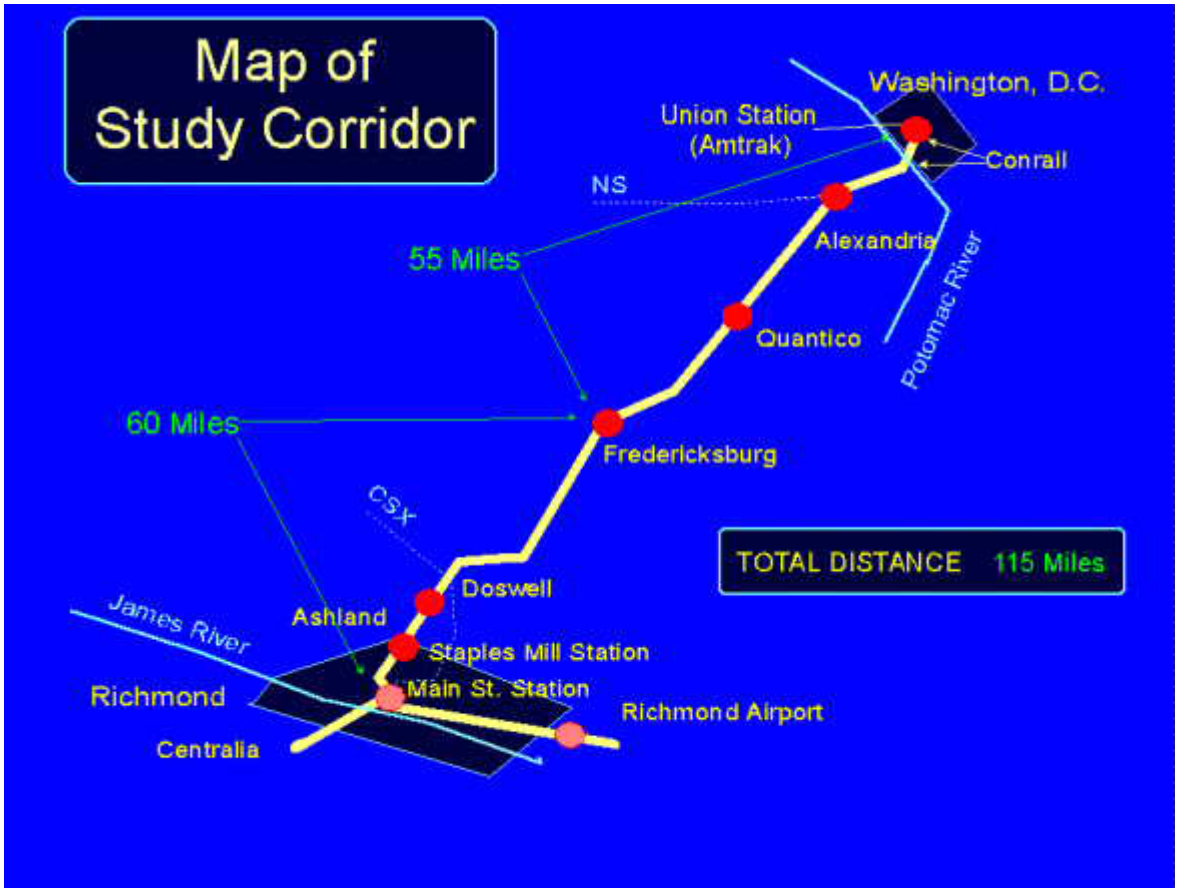
1. Assess current conditions.
2. Forecast travel demand.
3. Develop a system of improvements.
4. Project construction costs for selected improvements.

In addition, the consultants were asked to complete a fifth assignment:

1. Summarize six additional efforts - a preliminary assessment of the Washington, D.C.-to-Richmond Rail Corridor, a preliminary assessment of the Richmond-Hampton Roads Corridor, a preliminary analysis of a third track through the Corridor, planning for the Richmond Multimodal Transportation Center, an investigation of Corridor environmental considerations and development of land use strategies. The results were to be integrated into a Final Report for the General Assembly.

THE CORRIDOR STUDY'S FINDINGS
Interstate Highway I-95 -- which generally parallels the rail route through much of the Corridor -- is currently congested. Bus, car and truck trips take approximately two hours between Richmond and Washington, D.C., and longer during rush hours. Improvements in the rail corridor could permit increased speeds for the corridor passenger trains, resulting in shorter train travel times. The shorter travel times might convince more car drivers to become train passengers. If projected increases in vehicle traffic on I-95 can be reduced, funds spent on rail improvements may have a greater benefit than funds spent on increasing highway capacity.

An Historic Precedent -- According to Bob Kaplan and Deane Mellander in their book, *Richmond, Fredericksburg and Potomac Railroad, Linking North and South*, the Washington, D.C.-Richmond Rail Corridor has been a major force for economic development in Virginia since before the Civil War. Historically, one of the major sources of income for the railroads was rail passenger service. In 1943 an average of 103 trains -- one every 14 minutes -- passed through the corridor *daily*.
Better rail service could once again stimulate economic development in the region. From the north, Virginia could aggressively promote tourism fed by passengers already using trains on the Northeast Corridor. The Washington, D.C.-Richmond Corridor feeds the Northeast Corridor with thousands of passengers every year. Rail improvements in Virginia could extend the Northeast Corridor another 110 miles to the state capital. To the south, there is increasing interest in improving rail passenger service in the Carolinas, Georgia and Florida on rail lines that connect with the Washington-Richmond Corridor. Richmond and other Virginia communities would be more convenient for tourists, potential homeowners and businesses looking for building sites. Reduced vehicle traffic on I-95 would also reduce exhaust emissions and help Virginia control pollution. Finally, service to and from the urbanized Hampton Roads area could be improved. The Corridor Map is shown below.



Future Demand - Population on the Corridor is expected to grow from about 2.8 million in 1990 to more than 3.5 million in 2014. Employment will grow from about 1.9 million in 1990 to 2.7 million in 2014. Data collected from both automobile and rail passenger surveys in the Corridor, and the subsequent forecasting process, showed increasing demand for using rail service -- if running times were reduced and frequency of rail service was increased. These conservative estimates suggest ridership would increase if travel times were reduced. If train-trips were reduced to about 90 minutes, ridership would increase from its current 707,700 trips a year to more than 1.3 million in 2014. Improving rail travel time to 97 minutes and providing two additional trains per day would increase annual ridership to over 1.4 million in 2014. If trip times were 90 minutes and three more trains were added, annual ridership would increase to more than 1.6 million in 2014. Finally, 90-minute trips and hourly service would increase ridership to 2.2 million in 2014. Estimated total annual ridership is shown below.

ESTIMATED TOTAL ANNUAL RAIL RIDERSHIP (in thousands)

Scenario	1994	2000	2014
Existing Rail Service	707.7	868.4	1084.9
Improved 97-Minute Travel Time	872.9	957.4	1255.0
Improved 90-Minute Travel Time	920.5	1021.9	1320.1
Improved 97-Minute Travel Time Plus Two Additional Trains	1032.0	1103.9	1456.0
Improved 97-Minute Travel Time Plus Three Additional Trains	1073.9	1179.3	1539.8

Improved 90-Minute Travel Time Plus Two Additional Trains	1093.7	1187.0	1552.7
Improved 90-Minute Travel Time Plus Three Additional Trains	1160.7	1266.5	1628.1
Improved 90-Minute Travel Time Plus One Train Per Hour	1581.0	1724.7	2224.9

Future Revenues -- Using the same scenarios, 90-minute trips would increase annual revenues from the current $18.39 million to $31.36 million in 2014.
Ninety-seven minute trips and two additional trains per day would increase annual revenues to $34.95 million in 2014. Ninety-minute travel times and three more trains would generate $39.31 If the 90-minute alternate is combined with a frequency of service of one train per hour, total revenue can range from $38.94 million in 1994 to $54.70 million in 2014. Estimated total annual revenues for the various scenarios are shown below.

ESTIMATED ANNUAL EXPENSES AND REVENUES (Millions of 1994 Dollars)

		Operating Expenses		
Scenario	**Revenues**	**1994**	**2000**	**2014**
Existing Rail Service	$21.60	$18.39	$20.45	$25.46
Improved 97-Minute Travel Time	$21.80	$20.69	$22.64	$29.69
Improved 90-Minute Travel Time	$22.28	$21.88	$24.28	$31.36
Improved 97-Minute Travel Time Plus Two Additional Trains	$26.85	$24.83	$26.45	$34.95
Improved 97-Minute Travel Time Plus Three Additional Trains	$29.48	$25.91	$28.41	$37.12
Improved 90-Minute Travel Time Plus Two Additional Trains	$26.97	$26.35	$28.53	$37.35
Improved 90-Minute Travel Time Plus Three Additional Trains	$29.66	$28.10	$30.59	$39.31
Improved 90-Minute Travel Time Plus One Train Per Hour	$32.34	$38.94	$42.41	$54.70

ESTIMATED ANNUAL EXPENSES AND REVENUES (Millions of 1994 Dollars)

		Operating Expenses		
Scenario	**Revenues**	**1994**	**2000**	**2014**
Existing Rail Service	$21.60	$18.39	$20.45	$25.46
Improved 97-Minute Travel Time	$21.80	$20.69	$22.64	$29.69
Improved 90-Minute Travel Time	$22.28	$21.88	$24.28	$31.36
Improved 97-Minute Travel Time Plus Two Additional Trains	$26.85	$24.83	$26.45	$34.95
Improved 97-Minute Travel Time	$29.48	$25.91	$28.41	$37.12

Plus Three Additional Trains				
Improved 90-Minute Travel Time Plus Two Additional Trains	$26.97	$26.35	$28.53	$37.35
Improved 90-Minute Travel Time Plus Three Additional Trains	$29.66	$28.10	$30.59	$39.31
Improved 90-Minute Travel Time Plus One Train Per Hour	$32.34	$38.94	$42.41	$54.70

These amounts are total rail revenues, i.e. trips which are internal within the corridor, trips which begin within the corridor and are complete at locations beyond the corridor, and trips which begin beyond the corridor and are completed within the corridor.

Annual Operating and Maintenance Expenses -- All current rail passenger service in the corridor is operated by Amtrak. Six trains operate in each direction, with an additional train that runs to Newport News on Fridays and Sundays. While it is expected that Amtrak will continue to provide this service for the foreseeable future, Amtrak, because of financial limitations, is not in a position to implement new service. It is therefore assumed that any new service in the corridor would be initiated by the Commonwealth. The new service could be operated by Amtrak, or by another appropriate rail operating authority, such as Virginia Railway Express (VRE).
Expenses for the current Amtrak services were calculated by Virginia Department of Rail and Public Transportation (DRPT) based on Amtrak's FY 1995 budget for each route. Expenses for proposed additional service levels were calculated using FY 1996 budgeted costs for VRE. Total annual operating expenses for each operating scenario are shown in the table(s) above.

Needed Improvements -- To increase passenger train speeds, certain curves in the track should be straightened, new signals added, safety improved where tracks cross streets, new trackage constructed in several areas, and a third track added incrementally. With improvements completed, tilt-train rail technology could be introduced on the Corridor, further improving the running time and comfort for passengers.
The following is a listing of improvements, shown by priority based on critical need and cost effectiveness.

1. Raise the maximum speed to 80 mph where feasible.
2. Raise the daytime speed through Ashland to 45 mph.
3. Complete installation of constant warning time (CWT) devices at the remaining grade crossings and modify 21 existing installations.
4. Increase super elevations, accept greater unbalanced loads and straighten curves within the right of way.
5. Complete the Crystal City area VRE track changes.
6. Add 26 signals to reduce headways.
7. Eliminate the diamond (rail-rail crossing) at Doswell.
8. Install a new signal at North Possum Point (between MP 83.5 and 81.3).
9. Raise maximum speed to 90 mph.
10. Remove 45 mph restrictions (Conrail).
11. Construct an additional track between Alexandria and Fredericksburg.
12. Construct a new bridge at Quantico Creek, partially straighten a curve, permitting 80 mph and increased capacity.
13. Replace the existing No. 20 turnouts with equilateral No. 20 turnouts at both ends of the Quantico bridge (if a new bridge resulting in two-track capacity at Quantico Creek, item 12 above, is not constructed).
14. Procure high speed tilt equipment.
15. Install 10 double No. 32.7, 80 mph crossovers/new turnouts, including VRE additions.
16. Implement Richmond area track improvements.
17. Construct an additional track between Fredericksburg and Richmond.
18. Introduce high speed service (110 mph).
19. Consider electrification to increase power and acceleration, to improve air quality, and to be consistent with the Northeast Corridor.

In addition, the upgrading of existing stations at Staples Mill Road, Fredericksburg and Quantico for passenger convenience and comfort should be considered. There are also inadequate parking issues at stations which are used for both intercity and commuter services.
The phasing of improvements for reinstituting passenger service to the Richmond Main Street Station is described later in this report. Improvements at the Staples Mill Station should be coordinated with the planned service at the Main Street Station.
Cost Projections -- If all the improvements were constructed at once, it would strain public resources. Instead, an incremental approach has been proposed. This pragmatic, phased plan improves speed and service over several years. (The table below lists projected costs and a proposed schedule for improvements.)

PHASED RAIL IMPROVEMENT PROGRAM

Description of Improvements	Minutes Saved	Projected Cost
Stage 1 (80 mph)		
1. Raise corridor speed to 80 mph.	6.00	None
2. Raise speed through Ashland to 45 mph.	0.50	None
3. Finish installation of CWT2 devices (one site) and modify existing CWT installations at grade crossings.	---	$146,000
Stage 2 (80 mph)		
1. Increase super elevations, accept greater unbalanced load, straighten curves.	9.00	$1.5 million
2. Crystal City area track changes (VRE)	0.80	$3 million
3. Replace existing No. 20 turnouts north and south of Quantico bridge.	0.33	$350,000
Stage 3 (90 mph)		
1. Add 26 signals to reduce headways.	Capacity Increase	$7.8 million
2. Eliminate diamond at Doswell (CSXT)	0.83	$300,000
3. Install new signal at North Possum Point and increase speed from 55 to 70 mph.	0.75 (southbound only)	$200,000
4. Raise Corridor speed to 90 mph.	4.80	$400,000[3]
5. Remove 45 mph restrictions (Conrail)	0.50	$34,000
Stage 4 (90 mph)		
1. Construct an additional track between Alexandria Fredericksburg.	---	$13.2 million[4]
2. Construct new bridge at Quantico Creek (VRE)	0.24	$13.3 million (VRE)
Stage 5 (90 mph)		
1. Procure high speed tilt equipment.	---	$23 million per

		train
2. Install 10 double high speed crossovers/new turnouts, including VRE additions.	Capacity Increase	$32 million
3. New tracks Hermitage Road to Acca Yard.	---	$2.75 million [5]
4. Proposed wye at Richmond Airport.	---	$1.81 million[5]
5. Storage and service tracks at airport.	---	$1.88 million[5]
Stage 6 (110 mph)		
1. Construct additional track between Fredericksburg and Richmond	---	$119 million [4]
2. Introduce 110 mph service (tilt train), accept 7-inch unbalanced load.	30.00	$1.23 million[7]

As construction is completed, results could be tested and operations refined. Freight activity on the Corridor would not be disrupted and could benefit from improved speed and capacity of the railroad.

RELATED CORRIDOR ENHANCEMENT STUDIES
The URS Consultants Washington, D.C.-to-Richmond Rail Corridor Team coordinated with several other Virginia Department of Rail and Public Transportation (DRPT) contractors conducting transportation related activities in this and adjacent rail corridors. The following is a summary of each of these related efforts.
Preliminary Corridor Investigations (James R. Smith) -- Completed in August, 1992, by James R. Smith, Jr., a former senior engineer of the Richmond, Fredericksburg and Potomac Railroad, the study analyzed the feasibility of constructing an additional track, along the CSXT rail corridor, for high speed passenger service. Two options were analyzed:

1. Assumed that an operating speed of 150 mph would be attained wherever practical, with necessary alignment changes.
2. Assumed an additional track paralleling the existing track and using the existing right-of-way alignment, with any speed restrictions resulting from alignment or congestion.

The James R. Smith study estimates the 150-mph option with necessary alignment changes would cost approximately $435 million; the estimate for following the existing alignment is approximately $350 million. Neither of these cost estimates includes electrification.

Richmond-Hampton Roads Study (Donald W. Dodson) --- DRPT contracted with Donald W. Dodson to determine the feasibility of constructing an additional track adjacent to the existing CSXT track between Richmond and Newport News. Dodson's study assessed the existing conditions of the corridor and analyzed problem areas, including bridges and rights-of-way. Preliminary cost estimates for track and other improvements as well as cost estimates for electrification of the Corridor were provided. Conducted in two parts, the study's first part assumed the additional track will follow the existing CSXT alignment with an operating speed of 150 mph, except where limited by track restrictions.
The second part of the study assumed an operating speed of 150 mph, to be attained wherever practical, with necessary alignment changes. Both parts include speed restrictions in congested areas such as the cities of Richmond, Williamsburg, Newport News and adjacent suburbs.
In 1993, Dodson estimated the cost of an additional track for the existing alignment was approximately $222 million. The estimate for the alternative alignment was approximately $220 million. Neither of these costs included electrification. The estimate for the alternative alignment does not include land acquisition costs for approximately eight miles where the track would be located off the existing right of way.

Third Track/High Speed Train Scenarios (Wilbur Smith Associates) - DRPT asked Wilbur Smith Associates to use VRE's Dispatch Planning Model (DPM) to develop preliminary scenarios for the Corridor that assumed construction of a new third track dedicated to high speed trains.
Two different aspects of the existing right-of-way alignment were evaluated from DPM outputs:

1. How successful were high speed operations, given the alignment's geometric limitations?
2. How did high speed operations affect other services?

With the exception of a 10-mile section south of Fredericksburg, DPM outputs showed that there are few sections where high speed trains reached 110 mph for any significant distance because curvature restricted interspersing track speeds. A faster schedule should be possible using tilt equipment (i.e., the Spanish Talgo or the Swedish X-2000 trains) which are capable of higher curve speeds compared to conventional equipment. Alternatively, higher superelevation or allowable unbalance on the high speed track would improve running times.

Richmond Multimodal Transportation Center (Wilbur Smith Associates) --Historic Main Street Station, strategically located near the core of downtown Richmond, could serve rail and bus passengers, as well as air travelers through direct limousine service to the Richmond International Airport. Adoption of the concept and restoring Main Street Station into the Richmond Multimodal Transportation Center (RMTC) could enhance a redeveloping area of Richmond and stimulate travel between Richmond and Hampton Roads. The Feasibility Study recommends a three-phase implementation plan as shown below. Future intercity rail facility needs must be measured against projections of passenger activity. There is already evidence that the Staple Mill Road facility may inhibit growth in rail passenger travel. Amtrak has expressed their willingness to add Main Street Station to its schedule to attract more riders. The Main Street Station location would provide improved access for riders to the central Richmond area. Track and passenger facility changes are included in the abbreviated description of the Main Street phased activities that follow:

Phase I:

1. Newport News trains will continue to operate along the existing track on the east side of the trainshed.
2. No improvements to tracks or facilities except the addition of an east station platform and modest rehabilitation of the second floor of the headhouse.
3. An estimated 68,400 rail patrons annually would generate an estimated on-site retail/service sales of $40,000

Phase II:

1. Introduce trains originating in Richmond (Northeast Direct Service) to the track segment between the Staples Mill Road Station and the RMTC. Upgrading of the track segment is required.
2. Due to the difficulty in locating adequate room for turning facilities the use of push-pull equipment was adopted for study purposes.
3. An estimated 157,200 rail patrons per year would generate an estimated on-site retail/service sales of $80,000.

Phase III:

The relocation of intercity bus operation from the present bus terminal on North Boulevard to the RMTC will require suitable roadways, bus and passenger parking areas, and truck access for baggage/express operations. Interior space requirements include passenger areas (waiting and refreshments), ticketing, administrative offices, dormitory space for drivers, etc. In Phase III there will be significantly increased passengers, to include approximately 800,000 annual intercity bus riders. In addition, transportation services will include downtown trolleys, taxi, car rentals and limousine service. The following facility is envisioned:

1. An estimated 800,000 intercity bus and 232,900 intercity rail patrons per year would generate an estimated $275,000 on-site retail/ service sales.
2. The upper level of the train shed could be used for expanded train service and/or major museum/ public space including a Visitor's Information Center, a Virginia Commerce and Heritage Exhibit Center; the lower level could include specialty retail/kiosks, etc.
3. Outside, to the east of the headhouse, a three level parking deck to include retail space at the ground level, is proposed.

Environmental Considerations -- In a separate effort, the Environmental Division of VDOT conducted a "Preliminary Environmental Overview" of the Washington-to-Richmond Rail Corridor Study Area. This overview concluded that complete data must be derived from additional studies in order to prepare the required environmental documentation and permit applications at the implementation stage of the proposed project. "It is most likely that a draft and final environmental assessment will be required for the proposed

activity," the report stated. "However, depending on federal agency interpretation of the regulations, the activity may be determined to qualify for a categorical exclusion for NEPA requirements."
This environmental overview briefly discussed impacts of the following environmental considerations of the corridor area:

- Water and Wetland Resources
- Cultural Resources
- Threatened and Endangered Species/Wildlife
- Superfund Sites
- Air Quality

Land Use Strategies -- Two consultants developed land use strategies: Community Design Group, under an initial separate contract with DRPT; and Basile Baumann Prost & Associates, Inc., a member of the URS Consultants Team.
The Corridor is critical to the economic development of the Commonwealth and to an appreciation of its cultural heritage and natural beauty. To study land use in the Corridor, including existing and potential viable rail station location sites, DRPT retained the Community Design Group. Its study promotes growth in efficient and livable patterns and supports improved rail passenger service. The Community Design Group recommends improvements that would establish ridership and provide benefits to the cities and counties affected.
The following communities were selected for their development potential, their different geographical locations and the variety of community types they represent (from north to south): Lorton, Fairfax County; City of Fredericksburg; Carmel Church, Caroline County; Glen Allen, Henrico County.
To analyze land use, development, zoning, planning and development issues at individual station areas within the Corridor, Basile Baumann Prost & Associates, Inc., (BBP), a member of the URS Consultants Team, prioritized intercity rail station locations and identified opportunities for private sector/joint development.
Based upon previous evaluation of economic development factors, the community design factors addressed by the Community Design Group and the estimated existing and projected rail ridership, BBP established priorities for intercity rail stations. These priorities reflect a combination of private sector joint development opportunities and the feasibility factors related to ridership, travel time and station spacing.

CONCLUSIONS
The Washington, D.C.-to-Richmond Corridor continues to be the predominant rail transportation link between the Northeast Corridor and the eastern seaboard corridor, through the Carolinas and Georgia to Florida. Today, however, vehicular traffic, cars, trucks, busses and vans, along I-95 carry about 74 percent of the total passenger traffic through the Corridor. There is significant congestion on I-95, and there is concern that the congestion is adversely impacting the economic development of the region.
The *Rail Corridor Study* demonstrates how improvements to the freight/passenger rail facilities produces increases in track speed and capacity. The resulting reduced running time between Washington, D.C. and Richmond, combined with a higher frequency of trains, can provide a higher level of Corridor rail service, resulting in increased Corridor ridership.
The foregoing conclusions are entirely consistent with the September, 1994 *Final Report of the National Commission on Intermodal Transportation.* "The benefits of a National Intermodal Transportation System are enormous. Intermodalism offers the promise of: (1) lowering overall transportation costs by allowing each mode to be used for the portion of the trip to which it is best suited, (2) increasing economic productivity and efficiency, thereby enhancing the nation's global competitiveness, (3) reducing congestion and the burden on overstressed infrastructure components; (4) generating higher returns from public and private infrastructure investments, (5) improving mobility for elderly, disabled, isolated and economically disadvantaged; and (6) reducing energy consumption and contributing to improved air quality and environmental conditions."
Increased rail ridership offers the opportunity for communities which house rail stations to further develop economically viable and pleasant residential and commercial facilities in the proximity of those stations, with resulting environmental benefits to the affected communities.